

THREE NEW CASES OF POSSIBLE MATERNALISM IN NEOTROPICAL CENTIPEDES (CHILOPODA: SCOLOPENDROMORPHA)¹

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ABSTRACT: This paper reports three new cases of possible maternal care for Brazilian centipedes. The data presented suggest that, even for subsocial species, microhabitat selection may be an important form of parental investment in centipedes.

The class Chilopoda comprises about 2800 species divided into five orders (Lewis, 1981). Species of the orders Lithobiomorpha and Scutigermorpha lay eggs singly or in small batches inside natural cavities on the ground, covering them with soil debris. Females do not provide any additional care to the offspring in these groups. On the other hand, species of the orders Craterostigmomorpha, Geophilomorpha, and Scolopendromorpha lay eggs in clusters and females guard the eggs from oviposition to hatching, caring for the young until they disperse (Cloudsley-Thompson, 1958; Kaestner, 1968; Lewis, 1981).

The Scolopendromorpha contain heavy-bodied, flat centipedes that live in damp and dark places sheltered among the leaf litter, under rotten bark of fallen tree trunks, or in crevices. The order comprises about 550 species distributed throughout the world (Lewis, 1981) but maternal care has been reported for only nine species belonging to the following genera: *Cormocephalus* (Brunhuber, 1970; Lawrence, 1947), *Cryptops* (Cornwell, 1934; Johnson, 1952), *Otostigmus* (Machado, 2000), *Scolocryptops* (Auerbach, 1951), and *Scolopendra* (Heymonds, 1901; Klingel, 1960; Lewis, 1966).

Despite the large number of species of centipedes in the Neotropical region (see Bücherl, 1939, 1974) the behavior and ecology of the group is still poorly known. Studies on life history, sexual behavior and ecology of centipedes are critical, in order to determine how common are the diverse forms of parental investment in the group and their adaptive meaning. In this paper three new cases of possible maternal care are reported for Brazilian centipedes.

In March 1999 one female of *Otostigmus limbatus* Meinert, 1886 was found curled around first instar nymphs in the coastal sand forest of Cardoso Island, São Paulo state, southeastern Brazil (see description of the area in Machado &

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Vidal, 2001). The female (34.8 mm in length) and the young were found in an axil of the epiphytic bromeliad *Aechmea nudicaulis*. When disturbed during brooding the female abandoned the offspring. There were 30 non-pigmented nymphs with a mean length of 11.9 mm (S.D. = 0.28 mm; range = 11.6 - 12.4; n = 10). As for most scolopendromorphs (see Cloudsley-Thompson, 1958), the nymphs of *O. limbatus* hatch with 21 segments, the same number as the adults.

In March 2000 two females of *Cryptops schubarti* Bücherl, 1953 were found with offspring. The clutches contained 18 eggs and 43 nymphs. Brood-guarding females (21.0 and 34.0 mm in length, respectively) were found inside colonies of the ant *Camponotus* sp. in the Antena Mount (about 1300 m), near Barra da Estiva city, state of Bahia, northeastern Brazil. Both females were found curled around the offspring, laying on their sides and enclosing the eggs or nymphs between their legs and the ventral surface of their bodies. This behavior was also recorded for other centipedes species and seems to protect the offspring from contact with the substrate (Brunhuber, 1970; Lewis, 1981; Machado, 2000). The eggs are oval, white, and have a mean individual volume of 0.48 mm³ (S.D. = 0.11 mm³; range = 0.28 - 0.63 mm³; n = 10). The nymphs are non-pigmented, have a mean length of 7.44 mm (S.D. = 0.49 mm; range = 6.6 - 8.0 mm; n = 10), and display 21 segments upon hatching. When disturbed during brooding, the female with young abandoned the place whereas the female with eggs remained curled around the offspring. Although *C. schubarti* is commonly found in southwestern Brazil (mainly in São Paulo state), this is the first record of this species in the north-western region.

In March 2001 a female of *Dinocryptops miersi* (Newport, 1845) (43 mm in length) was found curled around a mass of first instar nymphs in a forest area in Cachoeira de Macacu, state of Rio de Janeiro, southeastern Brazil. There were 25 non-pigmented nymphs with a mean length of 11.4 mm (S.D. = 0.52; range 11 - 12 mm; n = 10). The guarding female was found curled around the young in an axil of an epiphytic bromeliad. When disturbed during brooding the female abandoned the nymphs. This is the first record of maternal care for a species of the genus *Dinocryptops*.

Brooding females of centipedes presenting maternal care are usually found coiled round the eggs or nymphs, with their ventral surface in contact with the offspring (Lewis, 1981). This stereotyped position is very similar to those described for the species studied in this paper. Although females were not seen grooming or protecting the offspring against predators, we assume that the behaviors described here correspond to cases of maternal assistance. As reported before for *Otostigmus scabricauda* (Machado, 2000), females taking care of nymphs seem to be more likely to abandon the offspring than those caring for eggs. A putative explanation for this difference is that, on the contrary of eggs, nymphs are able to flee and hide themselves after mother desertion.

The number of eggs recorded for subsocial centipedes range from 3 to 73 in the Geophilomorpha, and from 7 to 86 in the Scolopendromorpha (Lewis, 1981). Despite the low number of eggs (when compared with the non-subsocial Scutigermorpha and Litobiomorpha, see Lewis, 1981), the volume of the egg batch may comprise more than 80% of the female's body volume. As previously recorded for other arthropod groups, such as harvestmen (see review in Machado & Raimundo, 2001), the subsocial behavior in centipedes seems to be associated with reduction in fecundity and an increase in egg size. More information on these reproductive parameters is important in order to allow comparative analyses within and between the orders of the Class Chilopoda.

Previous observations have shown that maternal care is crucial for egg and young survival for species of the order Scolopendromorpha (Brunhuber, 1970). The data presented in this study also suggest that microhabitat selection may be an important form of parental investment in centipedes. Among geophilomorphs, for example, females of some species are highly selective in the choice of brooding site: *Schendyla nemorensis* use only the soil of an ant hill (Lewis, 1981), and *Orphnaeus brasiliensis* brood their eggs inside empty cocoons of moths (Jones et al., 1976). For the scolopendromorph *O. limbatus*, bromeliads may offer protection for the guarding female, which during the brooding is probably more exposed to predation, and also provide moisture for the eggs and nymphs, what can reduce their mortality by dehydration. In the case of *C. schubarti*, an ant nest may provide protection against some predators. Other individuals of the species (including adults and juveniles) were found under stones in the study area and it is possible that females use the ant colonies just as a brooding site. Although several species of millipedes can live within ant colonies (Hölldobler & Wilson, 1990), few species of centipedes have been recorded living in this particular microhabitat (Auerbach, 1951), and the present study provides the first report of the use of ant nests as brooding sites among centipedes.

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Dr. Simon and her colleagues have found genetic, morphological and behavioral evidence for a massive, permanent 4-year acceleration in which 17-year cicadas in the Midwest switched their life cycle to 13 years. She played recorded mating calls of 17-year, 13-year and "17-years that have switched to 13-years," to illustrate the reproductive character displacement found in the area of overlap. She said the new forms have now been named *Magicicada neotredecim*. All of the evidence supports the suggestion that 13-year cicadas in the Midwest are not true 13-year cicadas but are actually 17-year cicadas that have recently switched their life cycle to 13-years.

The talk was followed by a long and lively discussion period. Dr. Simon's full account of her work is at: <http://www.eeb.uconn.edu/faculty/simon/cicad.htm>

Prior to the talk, archivist Earle Spamer of the Academy of Natural Sciences library described the work recently completed by now-retired archivist Carol Spawn on the AES archives. Some of the materials were on display, including a letter from Lucy Say regarding the donation of Thomas Say's books to the Society, the original agreement between AES and the Academy from 1875, and artifacts including the Society seal and a box of black balls used in early elections of members (joining AES no longer requires a vote). The Society thanked the Library and the archivists for their efforts.

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